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Am I specific enough?

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AM I SPECIFIC ENOUGH?
PARTY PROGRAM SCOPE IN
MULTIDIMENSIONAL POLITICAL SPACES*

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SOM theme G Cross-contextual comparison of institutions and organisations

Abstract

The paper considers two ways how political parties can increase votes: by extending their appeal to a broader range of tastes, or by tailoring their offer to specific groups. The trade-off between the two gives rise to an optimal breadth of political address under a broad range of conditions. The vote-maximizing program scope changes with the number of issues (*n*) that govern political discourse. More than one beneficial program scope may also occur, leading to a dual-structure based on generalist and specialist parties that enjoy relative selection advantage over the other as new political issues are introduced or old ones are removed.

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1. INTRODUCTION

What is the optimal breadth of political address for a party? Making a broad, general appeal or coming up with a specific program designed to a well-defined target audience? Searching the answer to this question, the paper presents a spatial representation that is akin to the proximity models of electoral behavior (Downs 1957; Riker and Ordeshook 1973; Tullock 1972, Enelow and Hinich 1984, 1990; Kollman, Miller and Page 1992; Westholm 1997; Quinn, Martin and Whitford 1999). In proximity approaches, voters' choices depend upon the distance between party offer and the individual's political preferences, both depicted as points in an *n*-space of *n* political issues that characterize political discourse. A novelty of the present model is that a party's political stance is not a single point in the *n*-space, but rather, it covers a non-zero range of attitudes along each axis. There is a halo around the party's address point called the party's political niche or catchment area. This domain covers the people whom the party targets with its offer. The breadth of a party program is represented by the range of political tastes addressed by this program. The broader the catchment area, the bigger the program generality.

The paper studies two ways of vote maximizing. First, parties can enlarge their catchment area. Second, parties may try to obtain a bigger percentage of votes from the population within the catchment area. This latter can be done by dedicated offers suited to the demand of specific voter groups. The broadening of the catchment area has a positive and a negative effect on the number of votes. The positive effect is that the party's potential voter base increases as new members of the populace are addressed. The negative effect is that the offer has to be downscaled to the overlap in tastes of all targeted groups. Addressing a heterogeneous set of people works against the possibility of coming up with tailor-made bids for specific groups. For example, if a party broadens its range of address along the left-right axis to reach new leftist and rightist voters, then it has to make its program compatible with the variety of tastes in the enlarged catchment area. One option is to reduce program specificity to the common minimum. Alternatively, the party can make symmetric concessions to each group; e.g., promising more welfare measures for the leftists and reducing taxes for the rightists. The program "grays out" in the lack of well distinguishable characteristics in the first case, while it becomes incoherent in the second case. The resulting political message though may remain acceptable to all targeted people in a certain extent, but it won't be especially attractive to any of them. Constituencies find uncomfortable to support a party together with people whose political stances fall quite far from their own. A wider political appeal increases the number of potential voters, but it lowers the party's overall attraction, and so, the percentage of people in the catchment area who actually cast their vote to the party.

This trade-off can be seen as a special case of the organizational niche width problem in organizational ecology (Hannan and Freeman 1989; Péli 1997; Bruggeman and Ó Nualláin 2000). A wide (narrow) organizational niche may refer to a product structure designed to a broad (narrow) range of customers. Though the niche notion also has other connotations than political catchment area, it makes no harm to use the two concepts synonymously in the context of the present paper. Political parties, just like other organizations, can be typologized as specialists and generalists according to the breadth of their political niches. Generalist parties have broad niche, and their jack-of-all-trade strategy entails a neutral party program. Specialist parties have narrow niche, which they utilize efficiently with their well-fit exploitation technologies. (Figure 1).

The opposing tendencies between generalists' in-breadth and specialists' in-depth voter-base utilization can imply an optimal niche size, and so, an optimal political program specificity. How does this optimum look like, whenever it exists? What is the effect of adding new topics to political discourse on this optimum? To answers to these questions, the paper first outlines a mathematical model. Second, it derives formulae on optimal niche size, taking into account different voter tolerance patterns with respect to political program generalization. Third, the paper discusses the selective effects of the number of niche dimensions on specialist and generalist parties.

--- Figure 1 comes about here ---

2. THE MODEL

2.1 Address and attraction

Political preferences are characterized with *n* independent characteristics; each of them is displayed on an axis of the Euclidean issue-space. To avoid distortions due to different measurement units, interval scales are assumed along the axes with standardized variables. Each constituency has a most preferred position on each issue. The location that represents a voter's political preference is called his/her ideal point.

Each party program appeals to a certain range of political tastes within the populace. A party's opinion can be vaguer or sharper, i.e., general or specific, along the addressed issues. A party's political niche is defined as the domain that contains the political tastes addressed by the party program. The size of the niche (the breadth of address) is a deliberate decision of the party. A fragment of votes may even fall to a party outside from its catchment area. However, the model ignores this possibility being based upon the assumption that people cast their votes to a party if its political address meets their respective tastes.[1]

[1] This is clearly the case in the first election rounds in countries with a two-round election system like France or Hungary. People vote to their favored parties/candidates in the first round (a proximity choice), while they can vote against the "other side" in the second round (a directional choice, cf. Rabinowitz and Macdonald 1989; Macdonald, Listaugh and Rabinowitz 1991, 1998).

In proximity models, the utility of a party for a voter depends on the distance between their political stances. In the present model, a party's utility for the people varies according to its niche breadth. The more specific the program (narrower the range of address), the more attractive the party, and the bigger amount of votes it obtains from its niche. Figure 2 displays a possible relation between niche breadth, utility and the amount of obtained votes.

Address is a dichotomous variable: the ideal point of a certain taste group is either covered by the catchment area or it is not. Utility is a continuous variable with a range between 0 and 1. The party's utility refers to the percentage of people who vote to the party from its niche. Zero utility (attraction) yields no votes; if utility is 1, then everyone votes to the party from the niche.

--- Figure 2 comes about here ---

2.2 Catchment area shapes

In the simplest one-dimensional issue-spaces, the niche is a line segment. But what kind of geometric shapes can catchment areas take if $n > 1$? Niches are depicted as n-dimensional cubes (hypercubes) or n-dimensional spheres (hyperspheres) in the ecological literature of spatial modeling. In political science, these two modeling choices correspond to two distinct ways how voters judge party programs. First, the electorate can evaluate a program in respect of each political issue separately. A person falls into a party's niche if the distance between her/his ideal point ideal point and the center of the party program does not exceed r along any of the issues, where r stands for the half niche breadth. The mismatches between party and voter positions are evaluated separately along the axes; that is, the "errors" do not add up in the voters' perception. The obtaining party niches are n-dimensional cubes with $2r$ edges.[2]

A second interpretation on electoral perception assumes that voters consider the overall match between party offer and their political stance. People make cross-dimensional comparisons, measuring the pros and cons of programs, taking into account all political issues. Now, mismatches between party offer and voter preferences do add up in the voter's evaluation. Under this interpretation, the party-elector match can be characterized by their Euclidean issue-space distance, and this yields spherical catchment areas. Note that having the same $2r$ niche breadth, spherical niches are smaller in volume than cubic ones, reflecting a more critical electoral attitude. We opt for this second interpretation. But several of the coming findings will also apply to cubic niches.

Note moreover that the interval scales along the axes are composed of a finite number of categories in reality. Accordingly, the issue-space has a grain; it is composed of homogeneous taste cells instead of points. Therefore, the niche shapes only approximate spheres, and this approximation improves with the number of taste categories per axis.

Yet there is technical problem to be fixed. The relative importance of the involved political issues can be represented by weights assigned to the axes. These weights have a bearing on the catchment area shape; for example, people may tolerate less deviation from their own views on salient issues. Therefore, parties might have narrow address ranges when the importance of a political dimension is high. Assigning weights to the axes involve *affine* transformations on the niche shapes that can make, for example, non-regular rectangles from squares, and flat ellipses from

[2] Similarly, a biological specimen can survive within a given range of humidity, temperature and illumination (Hutchinson, 1978), a voluntary organization attracts members from the social n-space within a threshold distance along each axis (McPherson 1983). This mode of affiliation is called *boxicity* (Linton Freeman 1983).

circles. With unity weights in place, the address ranges can be equal along all axes; this implies geometrically far simpler catchment area shapes, and a simpler model. Fortunately, we can go along with unity weights without affecting the generality of the coming arguments. This is because affine transformations are linear, so one can always get back the original address ranges by multiplying the actual radius with the respective weights.

3. NICHE BREADTH CALCULATIONS

3.1 Niche volume and electoral support

The next task is to specify the vote-maximizing radius, R_0, of spherical party catchment areas in the n-dimensional issue-space. The number of people within the niche is proportional to its n-dimensional volume.[3] Let this volume measure directly the size of the population covered by the niche. The volume (V_n) of an n-dimensional sphere is:

(1) $V_n = K_n \cdot r^n$ where K_n only depends on n

The calculations reveal that K_n has no bearing on the results of the present part.[4] Formula (1) yields the volume of the n-dimensional cube if $K_n = 1$. Therefore, all coming results in this part apply also to cubic niches.

A party's utility to the constituency (attraction) is operationalized with the probability that a voter in the niche votes to the party. Let $U(r)$ denote a party's utility

[3] Competition (niche overlap) and inhomogeneities in the voter distribution within the niche may cause errors. Taking these external effects into account is a task of further research.

[4] Please find all calculation details of the coming arguments in the Appendix.

when its catchment area radius is r. Multiplying $U(r)$ with the sphere volume gives the party's voter support (S) measured in terms of the number of obtained votes:

$$(2)\quad S = V_n \cdot U(r)$$

$U(r)$ is assumed to be continuous and monotonically decreasing with r. Societies may differ in their sensitivity to party program specificity, therefore the graph of $U(r)$ can also be different. The existence and the magnitude of vote-maximizing niche breadth depend on the concrete shape of $U(r)$; therefore, a variety of potential utility function forms will be studied in the coming sections.

--- Figure 3 comes about here ---

3.2 Polynomial utility functions

Let's begin with the case when $U(r)$ is linear and party appeal is proportionally decreasing with catchment area radius (Figure 3a). Maximum utility is 1, so the applying linear functions are of the form (3). The voter support (4) has a maximum at (5). R_0 is the niche radius with which in place a party gets the biggest number of votes. Beyond R_0, the number of obtained votes gradually decreases to zero.

$$(3)\quad U(r) = 1 - ar \qquad \text{where } a > 0$$

$$(4)\quad S = V_n\,(1 - ar) = K_n\, r^n\,(1 - ar)$$

$$(5)\quad R_0 = \frac{n}{a \cdot (n+1)}$$

Formula (5) reveals that the vote-maximizing niche radius is sensitive to the number of aspects the voters take into account: R_0 is monotonically increasing with n towards an upper bound at $1/a$. The more issues are involved in the political discussion, the bigger the ideal niche size. This finding suggests that each added topic create a pressure that pushes parties towards generalism, other things being equal. Conversely, the elimination of issues may induce specialization. The niche breadth optimum acts as a filter: parties with a close-to-optimum niche size enjoy selection advantage.

How robust is the optimum shift with n? The growth of function (5) is concave, so adding a new issue has a stronger effect on the optimum when space dimension is low. In line with intuition, a newly introduced topic makes a bigger impact if political discourse comprises only a few issues. Adding a second axis to a one-dimensional space increases the optimal niche diameter with one-third, while a third dimension brings only a one-eighth (12.5%) change. Extensions into the fourth and fifth dimensions induce, respectively, 6.7% and 4.2% optimum increase (Table 1, first column).

The conclusion that optimal catchment area size increases with n relies upon the chosen shape of the utility function. Do some similar regularities apply when $U(r)$ is non-linear? This latter hypothesis is phrased out as a proposition, and it will be tested on other examples.

Proposition 1. The vote-maximizing party niche radius (program scope) monotonically increases with the number of political issues.

As a second step, I study non-linear polynomial utility functions of the form (6). Figure 3b displays the typical shape of the function graph.

(6) $U(r) = 1 - ar^k$ where $a > 0$ and $k > 1$

Having this kind of attraction pattern, people tolerate a certain extent of program deviation from their ideal point without seriously penalizing the party. Accordingly, the decline of $U(r)$ is modest at small radii. However, the fall becomes very steep at bigger r-s. The distinction between the zones of weak and strong responsiveness to niche extension becomes even more accentuated as k gets bigger in the exponent (Figure 3c). Multiplying the utility with the catchment area volume, the obtaining support function S has now a maximum at radius:

$$(7) \quad R_0 = \sqrt[k]{\frac{n}{a \cdot (n+k)}}$$

Table 1. The growth of optimal niche radius with new spatial dimensions (%). Polynomial utility functions.

n → n+1	**k = 1 linear case**	**k = 2**	**k = 3**	**k = 4**
1 → 2	33.3	22.5	17.0	13.6
2 → 3	12.5	9.5	7.7	6.5
3 → 4	6.7	5.4	4.6	3.9
4 → 5	4.2	3.5	3.0	2.7

Note. R_0 converges to 1 in formula (7) as k increases. This is why the vote-maximizing niche radius R_0 becomes less sensitive to the number of political issues at high k values.

The optimal niche breadth, R_0, concavely increases with the number of political dimensions towards an upper bound, in line with Proposition 1. Table 1 displays the relative change of the vote-maximizing niche radius as new political dimensions are added. Just like before, the general rule is that the optimal size is less affected by the emergence of a new political issue when space dimension is high.

3.3 Attraction decline without hitting the bottom

The functions studied up till now had the common property that utility reached zero at a certain niche radius, constituting an upper bound for R_0. But is there a finite optimal niche size if party utility never becomes zero? Functions of the form (8) are feasible candidates to model decreasing party appeal that approaches zero asymptotically.

(8) $U(r) = e^{-ar^k}$ where a and k are positive

(9) $R_0 = \sqrt[k]{\frac{n}{ak}}$

The formula yields an exponential function if $k = 1$, and it gives a Gaussian if $k = 2$ (Figure 3d-e). For $k > 1$, the short- and medium run behavior of (8) is similar to that of the polynomial functions in the previous section: a moderate utility decrease becomes robust beyond a niche radius. The difference comes in the longer run, function (8) smoothens out without hitting the bottom. The latter feature reflects the fact that a decreasing number of voters still stick to the party, even if its program scope is overspanned.

The maximal voter support obtains at (9). Again, the ideal radius becomes larger when new political dimensions are added, confirming Proposition 1. But now, R_0 grows without an upper bound. That is, the vote-maximizing niche size can increase beyond any limit as new political aspects are added to the issue-space. The optimum size is even proportionate to n if $k = 1$; then, each new political issue induces exactly the same shift in R_0.

This drive for boundless niche extension is not specific to exponential type utility functions. Function (10) features a similar change pattern to (8): first a moderate, then a pronounced and finally a smoothening out decrease without hitting the bottom (Figure 3e).

(10) $$U(r) = \frac{1}{a \cdot r^k + 1}$$ where k and a are positive constants

(11) $$R_0 = \sqrt[k]{\frac{n}{a(k-n)}}$$

One might also expect a similarity in the optimum change. But formula (11) discloses a new kind of behavior. Now, the optimal niche size only exists if the number of political issues is smaller than threshold k. If $n < k$, the optimum increases in a slowing down manner with n. But when the number of political issues reaches k, formula (11) does not yield a positive real number on R_0. Then, voter support becomes monotonically increasing with catchment area radius (note that now n is kept constant)! That is, unlimited niche extension becomes the way of getting more votes for any $n \geq k$. Parties simply cannot overstretch their political program; the bigger niche is the better.[5]

How strong is this pressure for boundless niche extension? Putting it differently, how does the support function's derivative (S') change with niche radius? If the derivative decreases, the surplus in votes becomes less and less with r, establishing a negative feedback that gradually stops down the niche extension. The

[5] This hectic sort of optimum behavior is not specific to the given attraction function form, see another example in the Appendix.

opposite outcome (S ' is increasing with r) would mean a positive feedback: the bigger the radius, the bigger the gain that comes from additional niche extension. In this case, one expects a well visible and robust political program-broadening race in the party population.

The calculations show that both of the two options might occur. Negative feedback applies if $n = k$; then, the surplus in votes coming from niche extension becomes less with r. But the rules of the game modify as n exceeds k. The derivative of S becomes growing with r and the positive feedback applies: the surplus votes of niche extension become even more numerous with r. Then, only effects that have not been discussed in this paper (like inertial forces against program change, the finiteness of the voter base) can put a leash on niche size explosion. The robustness of the process in case of positive feedback offers itself for empirical investigation. Can we identify situations in political history when parties reacted with a wave of strong program generalization to the appearance of a new political issue? Re-assessing stories of robust political "openings" (program scope broadening) in party histories, can we identify topics that had just gained importance by that time, offering a possible ex post explanation to the events?

3.4 More than one good program scopes

In the cases addressed up till now, voter support had utmost one maximum and the number of votes decreased monotonically towards zero beyond the vote-maximizing niche size. However, some support functions may increase again once r has passed the optimum value. Then, more than one local maxima may also occur. Consider a utility function $U(r)$ that asymptotically approximates zero and with which in place voter support has a single maximum. Add an arbitrary positive number to $U(r)$, see Figure 4.

(12) $U^{*}(r) = U(r) + c$ where c is a positive constant

Function (12) approximates value c instead of zero with r. With this utility function in place, there is a fixed minimum probability c that a constituency in the party's niche votes for the party, without respect to its program breadth. Such situation may occur when some people do not care about program specificity. These voters can be susceptible to simplified, general populist appeals without respect to program consistency. With utility function $U^{*}(r)$ in place, voter support always becomes increasing without an upper bound in the long run. This is because the surface below line c adds up to infinity with r. If parameter c is small enough, then the support function (S) can have a local maximum; for bigger radii, the support function goes downhill for a while, and finally it increases again in the rest of its domain (Figure 4a).

Voter support can also have multiple local optima. The function in Figure 4b yields a twin-peaked support pattern. In this example, the first peak locates at r_1 = 0.25, the second is at r_2 = 1.25 in a one-dimensional issue-space. Just like in the examples studied before, the maximum radii (r_1 and r_2) get larger with n. Moreover, the two peaks get farther from each other with n. Support functions with more than two local maxima can also be specified in a similar vein.

--- Figure 4 comes about here ---

The findings of this section may explain certain size-composition outcomes in party populations. It is a broadly registered fact in organizational science that the size distribution in organizational populations can be discontinuous: organizations in the middle size range are less frequent. One explanation is that the intensity of competition is size-dependent (Hannan and Ranger-Moore 1990). Big organizations (parties) fight most intensively with the bigger others. Therefore, medium big players have inferior survival perspectives relative to the stronger big organizations, and also to the small ones who (being insignificant) are exposed to weaker competitive pressures from the big ones. When organizations reach medium size, they can also suffer from the "liability of adolescence" that can come, for example, from a drift in environmental conditions relative to those that prevailed at the organization's founding (Hannan 1998).

A further explanation of size discontinuity in organizational populations comes from the resource partitioning model of organizational ecology. This theory predicts a dual population structure in mature markets, industries, and political systems, composed of a few big generalists at the center and a number of small specialists at the margins that do not get in the way of the big players there (Carroll 1985; Carroll and Hannan 1995, 2000).

The results of this section add to this list. The trade-off between party niche breadth and voter attraction can give rise to organization systems with smaller specialists and bigger generalists due to the existence of more than one beneficial niche sizes. Figure 4a exemplifies a case with a discontinuity with a single optimal specialist position besides which generalists can also reap lot of votes. Here, the recipe for party engineering is: specialize or be as generalist as possible. Figure 4b displays an optimal specialist position r_1, combined with one optimal generalist position r_2. Becoming a generalist from a specialist or vice verse is known to be a risky enterprise because of the inertial forces that hinder the required structural reorganizations (Hannan and Freeman 1989, Péli, Pólos and Hannan 2000). The valleys in the support functions displayed in Figure 4 indicate an additional roadblock to such transformations. A party that gradually changes its program scope may first lose support before it arrives to the new optimum niche size. It is a recurring question if gradualism or shock-therapy-style abrupt change is better at structural reorganizations. This example suggests that gradualism may not pay-off when the reorganization is about shifting niche size between two locally optimal positions. If you have a good reason to change, then do it with a single jump in such cases.

4. VOTE CHANGE WITH *N*

The previous part revealed that the vote-maximizing catchment area size tends to increase with n. But does having a larger optimum radius also imply having more votes? In general: not. Adding a new dimension to the issue-space can radically decrease the amount of obtained votes at any niche radius.

4.1 Thinning out

When a new political issue is introduced, the n-dimensional political tastes extend into n+1 dimensions and new taste combinations appear. The addition of a new topic may activate some abstaining voters so increasing the participation rate at the ballot, but the population size poses a strict upper bound on this process. Up till this point, the model could go along with the comforting assumption that the issue space is sufficiently broad in any directions. From now, the stretch of the taste distribution along the axes becomes crucial. Having, for example, 5 categories along each axis yields 5^n homogeneous taste cells in an n-dimensional space. Each new added issue divides the population, splitting up the cells, so the average number of people per cell (voter density) declines. As a consequence, the space thins out with n (Péli and Nooteboom 1999). Voter numbers in the catchment area will be lower in n+1 dimensions, parties lose votes at each dimensional extension, other things being equal.

4.2 Sphere volume change with *n*

The number of people in the niche can also increase or decrease simply due to the modification of niche geometry that comes with changing n. To demonstrate this effect, we have to know how sphere volume changes with the number of dimensions. For the sake of comparison, sphere radius is kept fixed now. This means that party utility is also kept constant, so party support (2) can only change due sphere volume effects. Function K_n in (1) played no role up till now. K_n gives the content of the unity radius sphere in n dimensions (Figure 5a). This volume is 2 for one-dimensional spheres (line segments), its value is π in two dimensions (circles), and it is $4/3\pi$ for 3D spheres.

Figure 5a displays an unforeseen effect: the unity sphere volume increases with n up till 5 dimensions, and from then it asymptotically declines towards zero. This non-monotonic pattern is not specific to unity spheres; it sustains in a broad range of sphere radii. However, an increase in r pushes the volume maximum towards higher dimensions. Conversely, the maximum moves to lower n-s as r becomes smaller (Figure 5a-b). If the radius is sufficiently small ($r \leq 2/\pi$), the hump in the graphs of Figure 5 completely disappears.

--- Figures 5a-b comes about here ---

Let's increase space dimension gradually from $n = 1$ in Figures 5b, now keeping the niche radius constant. The previous section disclosed the tendency that voter density declines with n. Now, we see that niche volume can first increase before it turns decreasing with n, having the radius fixed. In terms of voter support, these two (density and volume related) effects may work against each other when n is small (left from the volume maximum in Figure 5). If this is the case, then decreasing voter density might be compensated with the increase in niche volume implied by the dimension change. On the contrary, the thinning out and the volume loss effects reinforce each other as n becomes sufficiently high: then, both voter density and niche volume are decreasing with n. This second consideration gives rise to the following proposition:

Proposition 2. Parties lose support beyond a certain number of issue-space dimensions, whenever a new political issue is introduced.

Figure 5b shows that the value of n at which sphere volume is maximal is lower for parties of small niche radii. This points out the fact that there can be a range in n along which dimension change has an opposite effect on narrow-niche specialists than on generalist parties. Consider for example a specialist party with a niche breadth fixed at $r_1 = 0.5$ and a generalist party with a niche breadth fixed at $r_2 = 1$ (Figure 5b). Let the space dimension change from $n = 4$ to $n = 5$. Both parties would lose potential voters in the same extent due to the thinning out process described in the previous section. However, the generalist party's niche content will increase, because its volume maximum is at $n = 5$. The party gets potential voters from more taste-cells at five dimensions than in four, partly being compensated for the thinning out effect. But, the volume of the specialist party's $r_1 = 0.5$ broad niche is decreasing from its volume maximum at $n = 2$. Consequently, the specialist party loses voters due to both volume- and thinning out effects in the given example. The opposite happens when the issue-space dimension decreases: then, specialists gain relative advantage over generalists, if n is in the "right" range. These yield Proposition 3.

Proposition 3. There exist certain ranges of n along which:
adding a new issue improves the position of generalist parties relative to specialists;
removing an issue improves the position of specialists parties relative to generalists.

Proposition 2 stated that appending issues to the political discourse may not pay-off in terms of the absolute number of votes. However, it can bring a relative advantage to parties of a broad program scope, adds Proposition 3 to the picture. Specialism becomes an inferior way of vote collection as the number of issues grows beyond a limit. Conversely, generalism can become an inferior way of vote collection as the number of issues falls below a limit. For example, clear-cut party stances become important in times of wars or terrorist attacks, when the issue-space collapses and political discourse boils down to a few or even to a single issue.

5. DISCUSSION

The paper investigated the trade-off between the breadth of a party's political niche and the percentage of people who vote to the party from the niche. In case of all studied utility functions, Proposition 1 (optimal niche breadth increases with n) was supported, whenever the optimum existed. But, the change pattern of the vote-maximizing radius was dependent on the shape of the utility function. Having linear (3) or concave polynomial (6) functions, the always existing optimum moved towards a ceiling. The explanation is that all concavely or linearly decreasing utility functions become zero after a while, and this establishes an upper bound for voter support. A different optimum change pattern was registered when utility did not hit the bottom but approximated it beyond any limits. Having an exponential type utility change (8), the optimum increased along the whole range of n without an upper bound. In case of another asymptotic function, the optimal radius grew for a while with n, but it disappeared at a threshold. From then, unrestrained niche extension was the vote-maximizing strategy, even if the issue-space dimension was fixed. The calculations also exposed the possibility of a self-reinforcing niche extension loop when surplus vote becomes bigger at any increase of *r*, pushing parties towards further program generalization.

However, it is not proven in general that the optimal niche breadth increases with *r* for all monotonically declining utility functions. But, it can be shown that the optimum is always increasing (if exists), whenever the fall of utility with radius is concave, see the details in the Appendix.

The paper specified examples when a dual party population structure was expected with generalists and specialists. For example, an optimal specialist position can coexist with a "super generalist" position, if party support is monotonically increasing with *r* beyond the local optimum. This is the case, when a miniscule but fixed proportion of the voting population is insensitive to the specificity or to the consistency of the party program. We saw an example with two optimal niche radii; then, a structure with two prevalent (specialist and generalist) niche sizes is expected.

The observation that the optimal niche breadth tends to increase with *n* does not imply that parties earn more votes in higher dimensions. The issue space thins out with *n* because people are distributed along more and more cells. We also found some unexpected consequences of *n*-sphere geometry. Sphere volume, and so the amount of voters within the niche, can change non-monotonically with *n*; the sphere content first increases, and then it turns decreasing with space dimension, provided that radius is fixed at a sufficiently high value. But if the niche radius is small, the sphere volume monotonically decreases along the whole range of *n* (Figure 5). Therefore, the thinning out effect and the volume decrease effect will point into the same direction when *n* becomes high enough, and parties lose support at each upward shift in dimension (Proposition 2).

The turning point from which niche volume becomes decreasing with *n* moves upwards with niche radius. This implied that generalist and specialist parties might be affected differently by the change of space dimension (Proposition 3). Along certain ranges of *n*, an increase gives relative advantage to generalists over specialists, while a decrease favors specialists. Note that while Proposition 1 was justified only for certain utility function types, Propositions 2-3 are derived consequences, theorems, of the model.

Some issues for further research are the following. The findings of the paper rely on a number of assumptions. One premise is that the grain of the issue-space is fine, so the taste categories are distributed densely along the axes. Having only a few categories per axis would imply a coarse-grained issue space with big taste cells, making the approach with spherical niches untenable. A coarse grained issue-space makes certainly less trouble in case of rectangular niches. (As it was discussed before, all niche optimum calculations were insensitive to the choice between spherical and cubic niches).

A second supposition is that voter distribution does not change drastically in the neighborhood of the catchment area, so the amount of voters addressed by the party program can be estimated by the niche volume. This usually can be taken for granted for specialists, but not necessarily for bigger generalists. For the latter, the finite extension of the issue-space may also pose expansion limits. A third aspect that requires further elaboration comes from the fact that party catchment areas typically overlap. The mechanism that describes vote distributions between parties in their niche overlap cannot be based upon solely on program breadth. When voters are addressed by more than one party, they also compare their distances from the centers of the competing party programs, as it is described in the mainstream proximity models. Then, the proximity- and the niche breadth effects may determine party utility jointly. In this sense, the present model can be seen as a complement to the proximity approach, and building the two model machineries into one provides an agenda for future research.

6. REFERENCES

Bruggeman, Jeroen and Breanndán Ó Nualláin. 2000. "A niche width model of optimal specialization." *Computational and Mathematical Organization Theory*. 6:161-170

Carroll, Glenn R. 1985. "Concentration and Specialization: Dynamics of Niche Width in Populations of Organizations." *American Journal of Sociology* 90: 1262-1283.

Carroll, Glenn R. and Michael T. Hannan. 1995. "Resource Partitioning." Pp. 216-221 in *Organizations in Industry. Strategy, Structure, and Selection*, edited by G. R. Carroll and M. T. Hannan. Oxford, New York. Oxford University Press.

Carroll, Glenn R. and Michael T. Hannan. 2000. *The Demography of Corporations and Industries.* Princeton. Princeton University Press.

Downs, A. 1957. *An Economic Theory of Democracy*. New York. Harper and Row.

Enelow, James M. and Melvin J. Hinich. 1984. *The Spatial Theory of Voting: An Introduction.* Cambridge. Cambridge University Press.

Enelow, James M. and Melvin J. Hinich. (eds.) 1990. *Advances in the Spatial Theory of Voting*. Cambridge. Cambridge University Press.

Freeman, Linton C. 1983. "Spheres, Cubes and Boxes: Graph Dimensionality and Network Structure." *Social Networks* 139-156.

Hannan, Michael T. 1998. "Rethinking Age Dependence in Organizational Mortality: Logical Formalizations." *American Journal of Sociology* 104:85-123.

Hannan, Michael T. and John Freeman. 1989. *Organization Ecology*. Cambridge, Massachusetts. Harvard University Press.

Hannan, Michael T. and J Ranger-Moore 1990. "The Ecology of Organizational Size Distributions: A Microsimulation Approach." *Journal of Mathematical Sociology* 15:67-89.

Hutchinson, G. Evelyn. 1978. *An Introduction to Population Ecology.* New Haven. Yale University Press.

Kollman, Ken, John H. Miller and Scott E. Page 1992. "Adaptive Parties in Spatial Elections." *American Political Science Review*, 86:929-937.

Macdonald, Stuart E., Ola Listhaug and George Rabinowitz 1991. "Issues and Party Support in Multiparty Systems. *American Political Science Review* 85: 1107-1131. "

Macdonald, Stuart E., Ola Listhaug and George Rabinowitz 1998. "On Attempting to Rehabilitate the Proximity Model: Sometimes the Patient Just Can't Be Helped. *Journal of Politics* 60: 653-690.

McPherson, J. Miller. 1983. "An Ecology of Affiliation." *American Sociological Review* 48:519-532.

Quinn, Kevin M., Andrew D. Martin and Andrew B. Whitford 1999. "A Test of Competing Theories and Models." *American Journal of Political Science* 43: 1231-1247.

Péli, Gábor 1997. “The Niche Hiker’s Guide to Population Ecology: A Logical Reconstruction of Organization Ecology’s Niche Theory.” *Sociological Methodology* 27:1-46.

Péli, Gábor and Bart Nooteboom. 1999. "Market Partitioning and the Geometry of the Resource Space". *American Journal of Sociology* 104:1132-1153.

Péli, Gábor, László Pólos and Michael T. Hannan 2000. “Back to Inertia: Theoretical Implications of Alternative Styles of Logical Formalization.” *Sociological Theory*, 18 (2): 193-213.

Rabinowitz, George and Stuart E. Mcdonald 1989. "A Directional Theory of Issue Voting." *American Political Science Review* 83: 93-121.

Riker, William H. and Peter C. Ordeshook 1973. *An Introduction to Positive Political Theory.* Englewood Cliffs N.J., Prentice-Hall.

Tullock, Gordon. 1972. *Toward a Mathematics of Politics*. Ann Arbor, Michigan. University of Michigan Press.

Westholm, Anders 1997. "Distance Versus Direction: The Illusory Defeat of the Proximity Theory of Electoral Choice." *American Political Science Review* 91: 865-883.

7. APPENDIX

(1) $S = V_n \cdot U(r) = K_n r^n \, U(r)$ where K_n is a constant when n is fixed

(2) $S' = K_n \, (n r^{n\text{-}1} \, U(r) + r^n \, U'(r)) = K_n r^{n\text{-}1} \, (n \, U(r) + r \, U'(r))$

S has an extreme point different from zero (what is a maximum) if and only if:

(3) $n \, U(r) + r \cdot U'(r) = 0$

(4) $n = -\dfrac{r \cdot U'(r)}{U(r)}$

(4) is non-negative because r and $U(r)$ are non-negative, and $U'(r)$ is negative as utility is decreasing with r. If n increases in (4), then an increasing r implies a decreasing $U(r)$ in the denominator. So, the answer to the question if the optimal radius increases with n depends only on $U'(r)$. Then, the optimum is certainly increasing (whenever it exists), if $U'(r)$ is a negative constant or decreasing with n. Then, $U(r)$ is (weakly) concavely decreasing. Note that the optimum always exists in this case, because the right side of (4) is continuous function that takes the value zero at $r = 0$, and it is increasing without an upper bound; so, it equals n at a certain r value. However, if $U'(r)$ is strongly increasing with r, then it is not proven if it can or cannot turn the whole expression decreasing with r.

Polynomial utility functions

(5) $U(r) = 1 - ar^k$ where a and k are positive, and $k = 1$ gives the linear case

(6) $U'(r) = - akr^{k\text{-}1}$

Instantiating functions (5) and (6) to optimum condition (3), we get for the optimal radius R_0:

(7) $n(1 - a R_0^k) - R_0 \cdot ak R_0^{k-1} = n - a R_0^k(n + k) = 0$

(8) $n = a R_0^k(n + k)$

(9) $R_0 = \sqrt[k]{\frac{n}{a \cdot (n+k)}}$

Exponential type utility functions

(10) $U(r) = e^{-ar^k}$ where a and k are positive constants

(11) $U'(r) = -akr^{k-1} \cdot e^{-ar^k}$

Instantiating functions (10) and (11) to optimum condition (3), we get for optimal radius R_0:

(12) $n \cdot e^{-aR_0^k} + R_0 \left\{ -akR_0^{k-1} \cdot e^{-aR_0^k} \right\} = 0$

(13) $e^{-aR_0^k} \cdot \left(n - akR_0^k \right) = 0$

As the exponential factor in (13) is always positive, the expression in parenthesis has to be zero. Then:

(14) $R_0 = \sqrt[k]{\frac{n}{ak}}$

Another function with the asymptotic property

(15) $U(r) = \dfrac{1}{ar^k + 1}$ where k and a are positive constants

(16) $U'(r) = -\dfrac{akr^{k-1}}{\left(ar^k + 1\right)^2}$ where k and a are positive constants

Instantiating functions (15) and (16) to optimum condition (3), we get for optimal radius R_0:

(17) $$\frac{n}{aR_0^k + 1} + R_0\left\{-\frac{akR_0^{k-1}}{\left(aR_0^k + 1\right)^2}\right\} = 0$$

(18) $$n - \frac{akR_0^k}{aR_0^k + 1} = 0$$

(19) $$naR_0^k + n - akR_0^k = 0$$

(20) $$aR_0^k(n-k) + n = 0$$

(21) $$R_0 = \sqrt[k]{\frac{n}{a(k-n)}}$$

Equation (17) was multiplied by an item that contained variable R_0, and this may cause the appearence of false roots. Instantiating (21) into (17) reveals that (21) is a root indeed.

The speed of support change with *r*, if $n \geq k$

$$(22) \quad S = K_n \cdot r^n \frac{1}{ar^k + 1}$$

$$(23) \quad S' = K_n \cdot \left\{ \frac{nr^{n-1}}{ar^k + 1} - r^n \cdot \frac{akr^{k-1}}{\left(ar^k + 1\right)^2} \right\} = \frac{K_n r^{n-1}}{\left(ar^k + 1\right)^2} \cdot \left\{ ar^k (n-k) + n \right\}$$

If $n = k$, then:

$$(24) \quad S' = \frac{nK_n r^{n-1}}{\left(ar^k + 1\right)^2} < \frac{nK_n r^{n-1}}{\left(ar^k\right)^2} = \frac{nK_n}{a^2} \cdot \frac{1}{r^{n+1}}$$

The right side of (24) converges to zero asymptotically with *r*, and so S' also approaches zero asymptotically. That is, the growth of *S* slows down with *r*.

If $n = k + 1$, then:

$$(25) \quad S' = \frac{K_n r^{n-1}}{\left(ar^k + 1\right)^2} \left(ar^k + n\right) > K_n \frac{ar^{k+n-1}}{\left(ar^k + 1\right)^2} = K_n \frac{ar^{2k}}{a^2 r^{2k} + 2ar^k + 1} = K_n \frac{r^{2k}}{ar^{2k} + 2r^k + \frac{1}{a}}$$

If $R \to \infty$, the right side of (25) is monotonically increasing towards limit value K_n/a. This means that S' is also monotonically increasing with *r*. So, the gain in votes gets bigger with the niche radius if $n = k + 1$.

If $n > k + 1$, then the right side of (25) is multiplied by r^u, where $u \geq 1$. In these cases the vote surplus due to niche extension increases even without an upper bound with *r*.

A convex utility function

$$(26)\quad U(r) = \frac{1}{(ar+1)^k} \qquad \text{where } k \text{ and } a \text{ are positive constants}$$

$$(27)\quad U'(r) = -\frac{ka}{(ar+1)^{k+1}}$$

Instantiating functions (26) and (27) to optimum condition (3), we get for optimal radius R_0:

$$(28)\quad \frac{n}{(aR_0+1)^k} + R_0\left\{-\frac{ak}{(aR_0+1)^{k+1}}\right\} = 0$$

$$(29)\quad n - \frac{akR_0}{aR_0+1} = 0$$

$$(30)\quad naR_0 + n - akR_0 = 0$$

$$(31)\quad aR_0(n-k) + n = 0$$

$$(32)\quad R_0 = \frac{n}{a(k-n)}$$

Equation (28) was multiplied by an item that contained variable R_0, and this may cause the appearence of false roots. Instantiating (32) into (28) reveals that (32) is a root indeed.

The speed of support change with r, if $n \geq k$

$$(33) \quad S = K_n \cdot r^n \frac{1}{(ar+1)^k}$$

$$(34) \quad S' = K_n \cdot \left\{ \frac{nr^{n-1}}{(ar+1)^k} - \frac{akr^n}{(ar+1)^{k+1}} \right\} = \frac{K_n r^{n-1}}{(ar+1)^{k+1}} \cdot \{ ar \cdot (n-k) + n \}$$

If $n = k$, then:

$$(35) \quad S' = \frac{nK_n r^{n-1}}{(ar+1)^{k+1}} < \frac{nK_n r^{n-1}}{(ar)^{k+1}} = \frac{nK_n}{a^{k+1}} \cdot \frac{1}{r^2}$$

The right side of (35) converges to zero asymptotically with r, and so S' also approaches zero asymptotically. That is, the growth of S slows down with r.

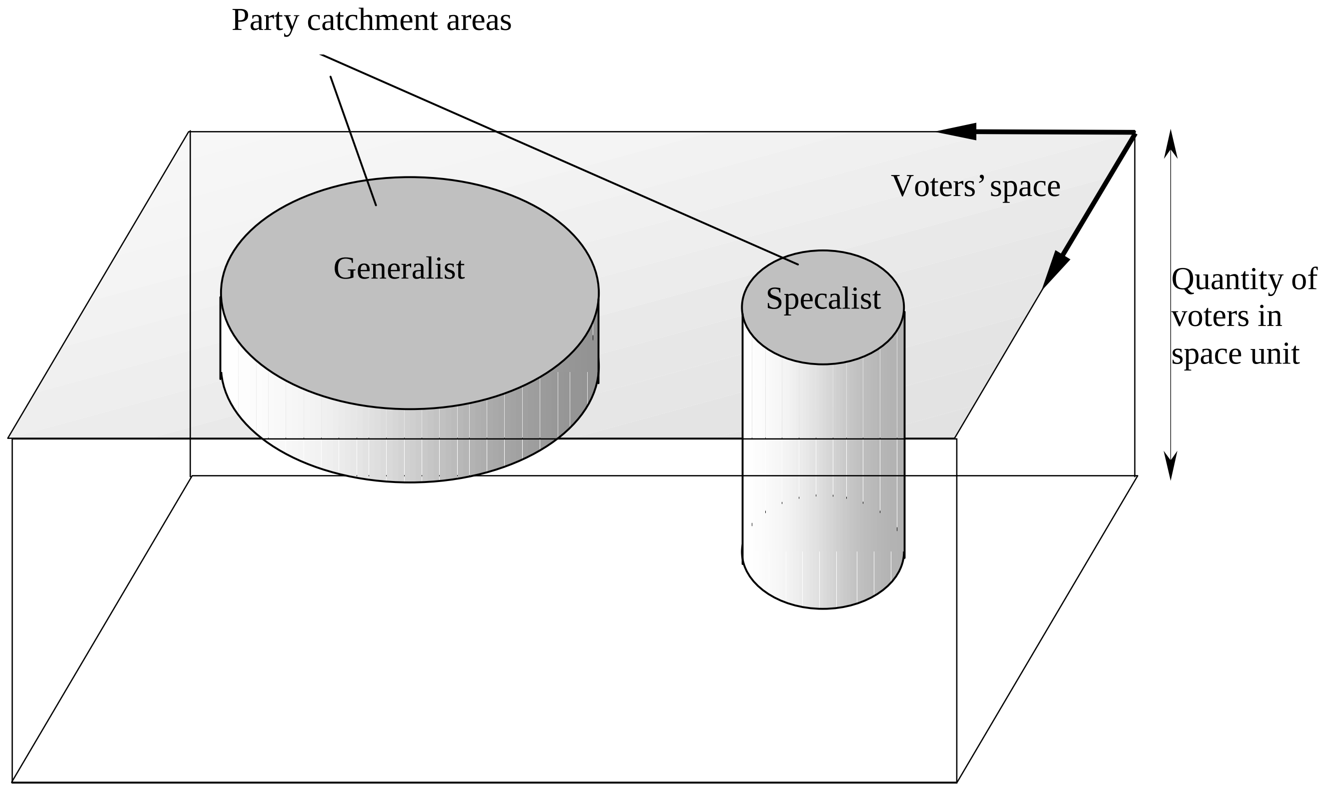
If $n = k + 1$, then:

$$(36) \quad S' = \frac{K_n r^{n-1}}{(ar+1)^{k+1}} \cdot (ar+n) > \frac{K_n r^{n-1}}{(ar+1)^{k+1}} \cdot ar = \frac{aK_n r^n}{(ar+1)^n} = aK_n \left(\frac{r}{ar+1} \right)^n$$

If $R \to \infty$, the right side of (36) is monotonically increasing towards the limit value K_n/a^{n-1}. This means that S' is also monotonically increasing with r. So, the gain in votes gets bigger with the niche radius if $n = k + 1$.

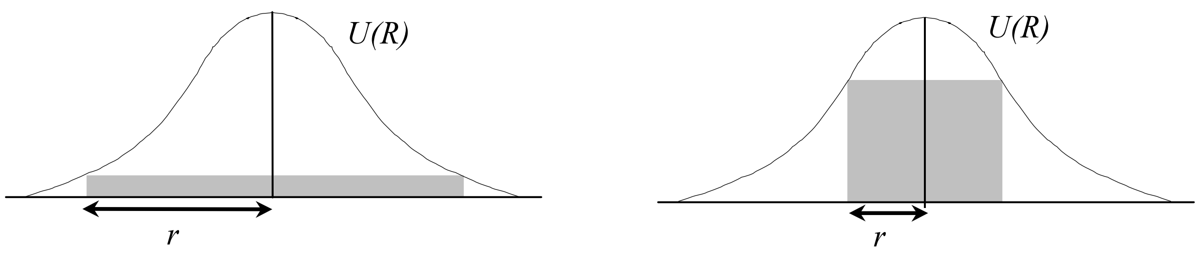
If $n > k + 1$, then the right side of (36) is multiplied by r^u, where $u \geq 1$. In these cases the vote surplus due to niche extension increases even without an upper bound with r.

Figure 1. Generalist and specialist party adress:
In-breadth versus in-depth voter base utilization



The voters' space is two dimensional in this example. Cilinder volumes stand for the amount of votes obtained by the parties.

Figure 2. The change of obtained votes with niche breadth



The horizontal axis stands for a one-dimensional preference space. The rectangles represent the amount of obtained votes at niche radii r_1 and r_2. Utility function $U(r)$ is Gaussian in this example.

Figure 3. Utility function patterns

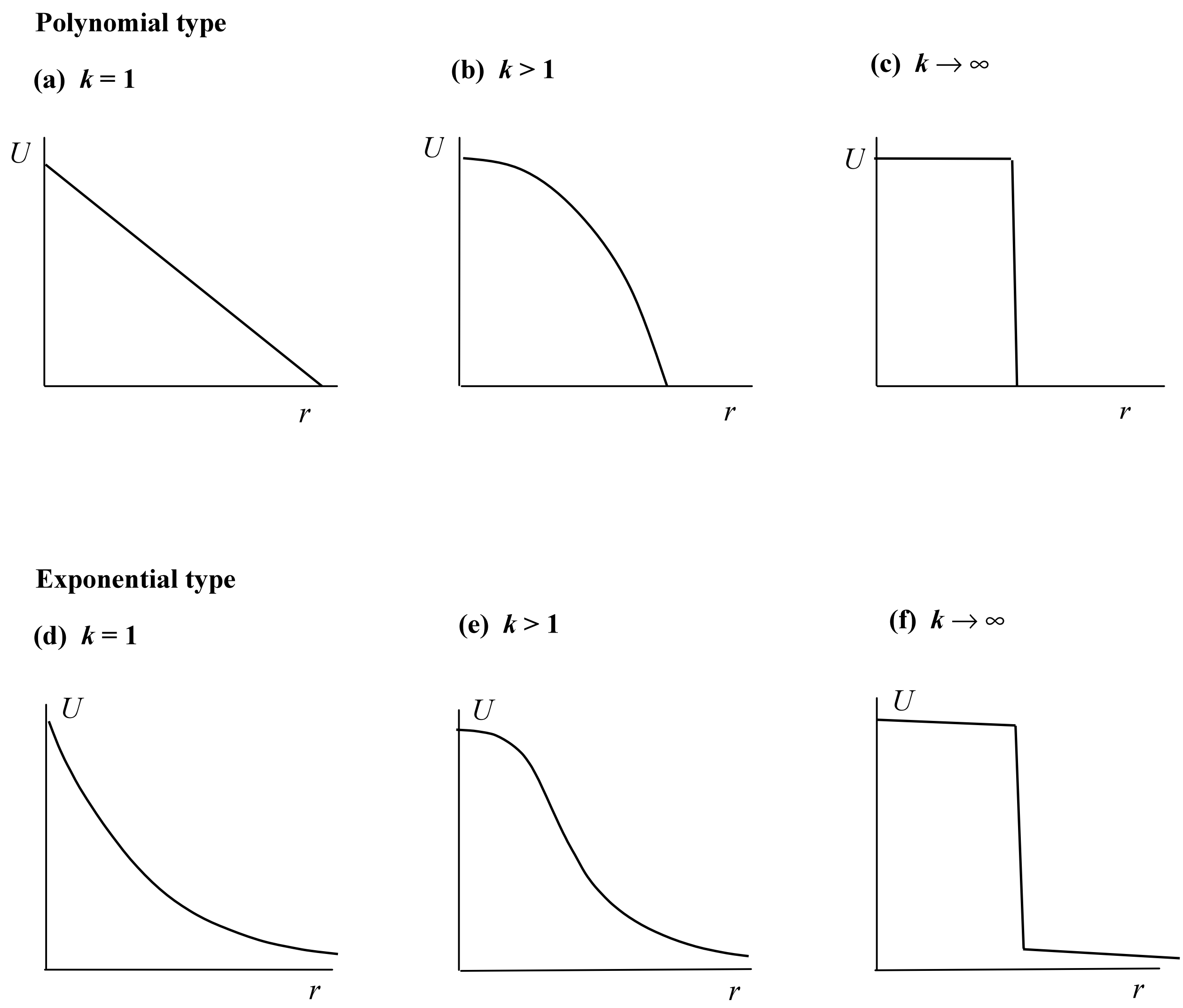
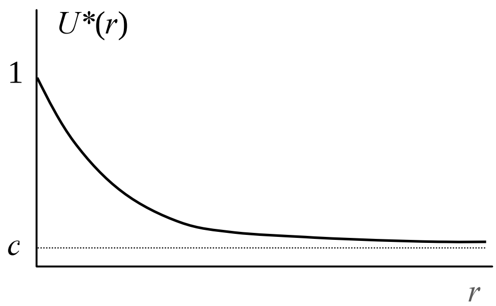
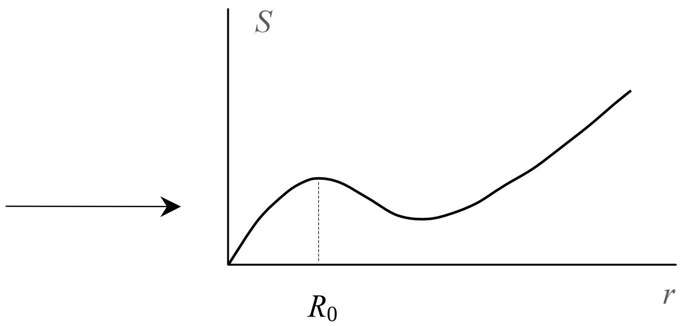


Figure 4. Support functions with local maximum

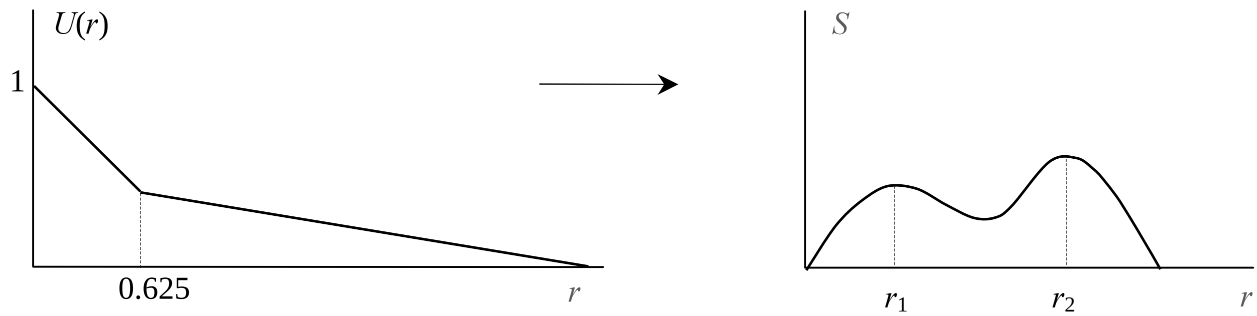
(a)



Note. Parameter c is small.

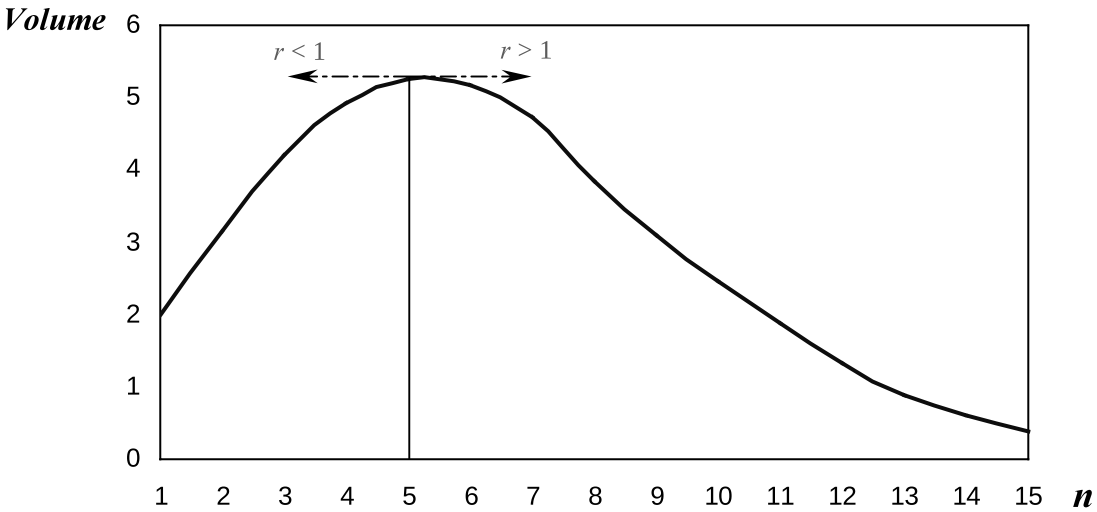


(b) Multiple maxima



$$U(r) = \begin{cases} 1 - r & \text{if } r < 0.625 \\ 0.5 - 0.2 \cdot r & \text{if } r \geq 0.625 \end{cases}$$

Figure 5a. The change of unit sphere volume (K_n) with *n*



The arrows show the direction where maximum volume moves if *r* changes.

Figure 5b. Sphere volume change with *n* and *r*